Citation:

Timlin MT, Pereira MA, Story M, Neumark-Sztainer D. Breakfast eating and weight change in a 5-year prospective analysis of adolescents: Project EAT (Eating Among Teens). Pediatrics. 2008 Mar;121(3):e638-45

PubMed ID: 18310183

Study Design:

longitudinal prospective cohort

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the association between breakfast frequency and relative body weight in both cross sectional and prospective (5 year body weight change) analyses in adolescent males and females.

Hypothesis:

- Breakfast frequency would have an inverse association with body weight and with weight gain.

Inclusion Criteria:

Students must have been enrolled in public middle and high school in the Minneapolis St. Paul, Minnesota area in 1998-1999.

No other inclusion criteria described in this paper

Exclusion Criteria:

- Those with daily energy intakes that reflected <1673.6kJ (<400 kcal) or >29 288 kJ (>7000 kcal)
- Those who did not complete the Youth and Adolescent Food Frequency Questionnaire (YAQ) at time 1 or time 2

Description of Study Protocol:

Recruitment

- Students must have been enrolled in public middle and high school in the Minneapolis St. Paul, Minnesota area in 1998-1999;
- 31 different school communities participated.
- No other recruitment criteria described

Design

longitudinal observational study

Blinding used (if applicable)

n/a

Intervention (if applicable)

During the1998-1999 school year, the following data was collected in the classrooms:

- Project EAT-1 survey:221 item self-report instrument assessing a range of socioenvironmental, personal and behavioral factors
- Youth and Adolescent Food Frequency Questionnaire (YAQ)
- Anthropometric Data

Five years later (2003-2004), Project EAT-2, a longitudinal follow-up study of Project EAT-1 surveyed all of the original participants via mail to assess changes in eating patterns and weight status

Statistical Analysis

- For descriptive purposes, unadjusted (or age-adjusted) associations between covariates and breakfast categories were examined using x^2 tests or simple linear regression models
- Multiple linear regression was used to examine the association between breakfast categories and BMI at times 1 and 2 for cross sectional analyses.
- For prospective analyses, the dependent variable was time 2 BMI, with time 1 BMI as a covariate.
- Age, gender, SES, race, smoking, alcohol, baseline BMI and physical activity were adjusted as potential cofounders in model 1.
- Gender was treated as a covariate, because the association between breakfast frequency and BMI was similar between boys and girls (P>0.30 for breakfast x gender interaction)
- In model 2, dietary factors that may be confounders or mediators of hte breakfast-BMI association were adjusted (including energy and macronutrient intake, fiber, and the breakfast-specific groups)
- In model 3, weight-related concerns and perceptions identified as possible upstream determinants of breakfast frequency were added.

Data Collection Summary:

Timing of Measurements

Data was collected during the 1998-1999 school year

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Dependent Variables

- BMI - calculated according to the formula: weight in kilograms divided by the square of height in meters (kg/m^2)

Independent Variables

- Dietary intake - assessed with the 149-item Youth and Adolescent Food Frequency Questionnaire (YAQ)
- Breakfast Frequency - assessed with the question "During the past week, how many days did you eat breakfast"?
- Weight relationed concerns and perceptions - assessed using the Project EAT survey
- Physical Activity - assessed with the question "in a usual week, how many hours do you spend doing the following activities?"
- SES was primarily determined by parental education level defined as the highest level of educational attainment of either parent

Control Variables

none described

Description of Actual Data Sample:

Initial N: 4746 students

Attrition (final N): 2216 students (1007 boys and 1215 girls)

- 1074 were lost to follow-up for Project EAT-2
- 1154 did not complete the Project EAT-2 survey
- 296 surveys were missing data

Age:

Time 1: 14.9±1.6 years

Time 2: 19.4±1.7 years

Ethnicity:

- 63.1% white
- 9.9% black
- 17.7% Asian
- 3.8% Hispanic
- 2.7% Native American
- 2.85% mixed or other

Other relevant demographics: n/a

Anthropometrics: not described

Location:

Minneapolis St. Paul, Minnesota area

Summary of Results:

Key Findings

- Those individuals who never ate breakfast were more likely to be girls (16.4%) than boys (13.0%; P=0.03), whereas those who ate breakfast daily were more likely to be boys (37.9%) than girls (27.2%; P<0.001).
- The greatest change in time was observed in boys, where there was a 16.8% decrease from time 1 to time 2 in the participants who ate breakfast daily, such that at time 2 there was no difference in the prevalence of daily breakfast by gender (P=0.96)
- At time 1, when age was examined by breakfast category, those who ate breakfast daily were younger (14.7±1.6 years), whereas those who never ate breakfast were older (15.3±1.5 years), P<0.01
- Those who ate breakfast were more likely to be white, to come from higher SES, and to engage in higher levels of physical activity.
- In girls, the overall diet of daily breakfast eaters was higher in total energy (kilojoules), fiber (grams per 1000 kcal), and cholesterol (grams), compared with those who were intermittent or never eaters.
- In boys, statistically significant differences by breakfast frequency were observed for dietary carbohydrate and fiber (higher for daily breakfast) and for the percentage of calories from saturated fat (lower for daily breakfast)
- At time 1: compared with daily breakfast eaters (BMI=21.7+0.16 kg/m^2), a higher BMI was observed in those who ate breakfast intermittently (22.5+0.12 kg./m^2) or never (23.4+0.24 kg/m^2) P<0.01. Similar associations were observed at time 2.
- The inverse associations between breakfast frequency and BMI remained largely independent of all confounding and dietary factors and were similar for boys and girls (P> 0.10 for gender x breakfast interaction).
- The frequency of eating breakfast was inversely associated with BMI in a dose-response manner (P<0.01)

Breakfast Frequency by Gender

Time Point	Breakfast Frequency, %		
	Daily	Intermittent	Never
Baseline (1999)	n=764	n=1152	n=300
Girls	27.2	56.5	16.4
Boys	37.9	49.1	13.0
Time 2 (2004)	n=497	n=1390	n=329
Girls	21.2	65.0	13.8
Boys	21.1	60.0	18.9

Time 1 Correlates of Breakfast Habits

Variable	Breakfast Frequency				
	Daily	Intermittent	P	Never	P
	(n=764)	(n=1152)		(n=300)	
Age, y, mean±SD	14.7±1.6	14.9±1.6	<.01	15.3±1.5	<.01
Race, white, %	59.3	48.6	<0.01	45.2	<.01
SES, highest, %	22.2	11.4	<.01	7.0	<.01
Physical Activity	26.5	18.5	<.01	16.1	<.01
high strenuous, %					
Alcohol, weekly, %	2.7	6.3	<.01	13.4	<.01
Smoking, daily, %	4.6	10.9	<.01	18.4	<.01

All P values represent comparisons with the daily group

Author Conclusion:

- As rates of breakfast consumption decrease throughout adolescence and into adulthood, the impact of regular breakfast consumption on public health may be significant
- More emphasis should be placed on breakfast habits, especially among adolescents and young adults, when behavioral patterns are developing and stabilizing.
- Future studies should further examine the role of breakfast habits among youth who are particularly concerned about their weight.

Reviewer Comments:

The paper states that data was excluded for:

- *those with daily energy intakes that reflected <1673.6kJ (<400 kcal) or >29 288 kJ (>7000 kcal)*
- *Those who did not complete the Youth and Adolescent Food Frequency Questionnaire (YAQ) at time 1 or time 2*

But it does not say how many students this accounted for. There are 6 students that are not accounted for so an assumption can be made that the 6 were excluded for these reasons.

3 Limitations stated in the discussion:

- *The self reported nature of the data for exposure, as well as outcome variables, may bias the associations toward the null hypothesis because of nondifferential misclassification*
- *It is possible that measurement error in the potential confounding or mediating variables may have biased*

associations away from the null.

- *A causal link between breakfast habits and BMI cannot be determined, because the present study was only observational in nature*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	Yes
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	Yes
Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes

3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	Yes
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	No
4.4.	Were reasons for withdrawals similar across groups?	Yes
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes

	7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
	7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
	7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
	7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
	7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
	7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
	7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**		Yes
	8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
	8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
	8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
	8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
	8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
	8.6.	Was clinical significance as well as statistical significance reported?	Yes
	8.7.	If negative findings, was a power calculation reported to address type 2 error?	No
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**		Yes
	9.1.	Is there a discussion of findings?	Yes
	9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**		Yes
	10.1.	Were sources of funding and investigators' affiliations described?	No
	10.2.	Was the study free from apparent conflict of interest?	Yes